आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

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The Presentation

On

Subject name : HAP (Human anatomy & physiology),

Endocrine system

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Our body is contains **two** kinds of gland

1. **Exocrine gland (with duct) :** secrete their product into body duct
   ex: sebaceous gland, digestive gland
2. **Endocrine gland (without duct):** secrete their product (hormones) directly into the extracellular space around the secretory cell

Hormones are chemical messenger, having the wider variety of effects and their function, some time it may be sudden or some time may occurs days later

It maintained the various functions of the body for examples regulate the body temperature, regulate the homeostasis, maintain trauma, emotional stress etc.

Endocrine system

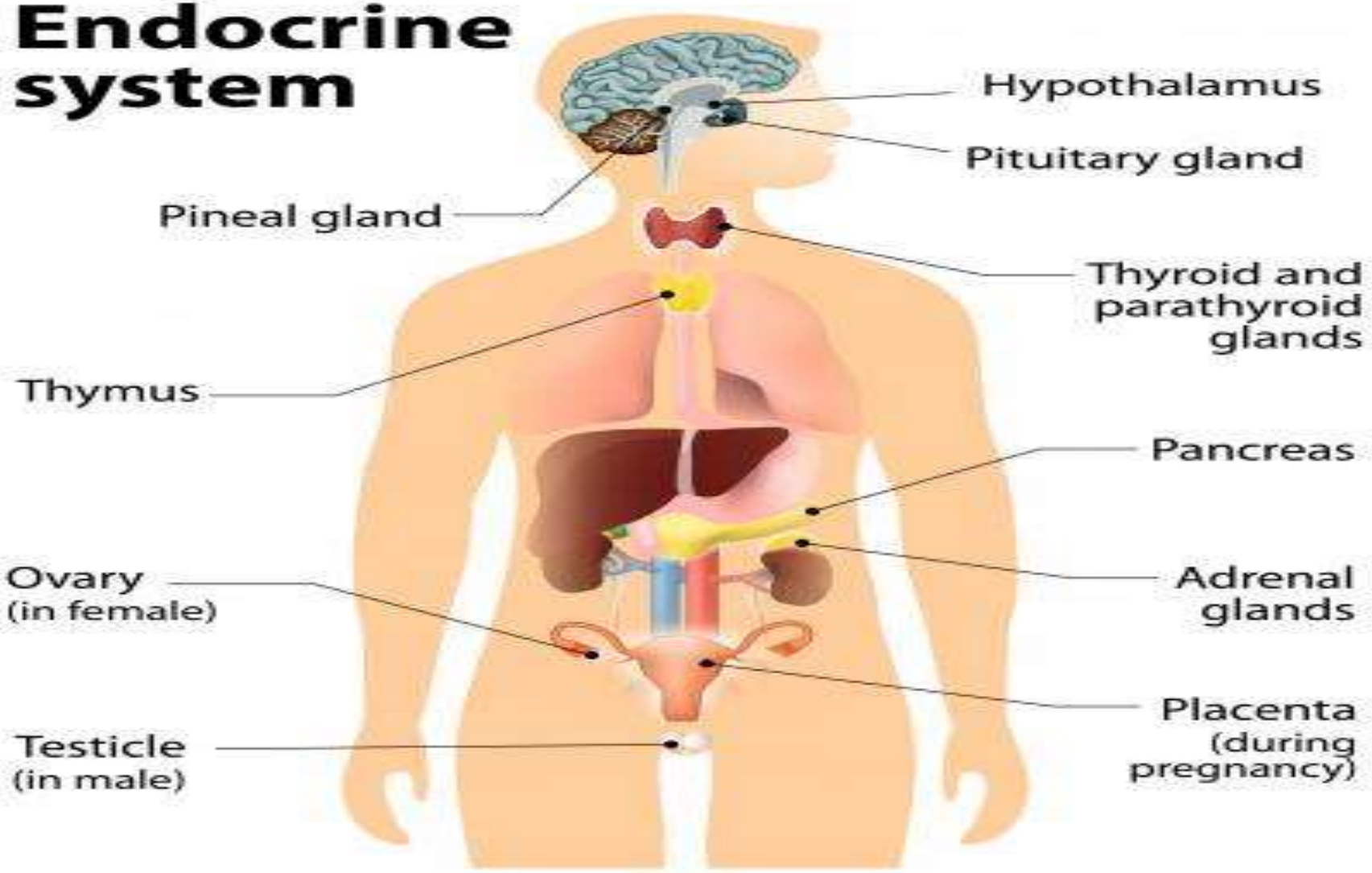
The endocrine system regulates body activities by the releasing hormones into blood stream , from where they are carried out through the whole body

we can study the endocrine gland and their releasing hormones in the endocrine system and the science of endocrine system is known as **Endocrinology**.

The endocrine system is compromising the following endocrine glands:

1. **The pituitary gland**
2. **Thyroid gland**
3. **Parathyroid gland**
4. **Adrenal gland**
5. **Pineal gland**
6. **Sex gland (gonads)**
7. **Pancreas**
8. **Thymus gland**

Endocrine system



The pituitary gland:

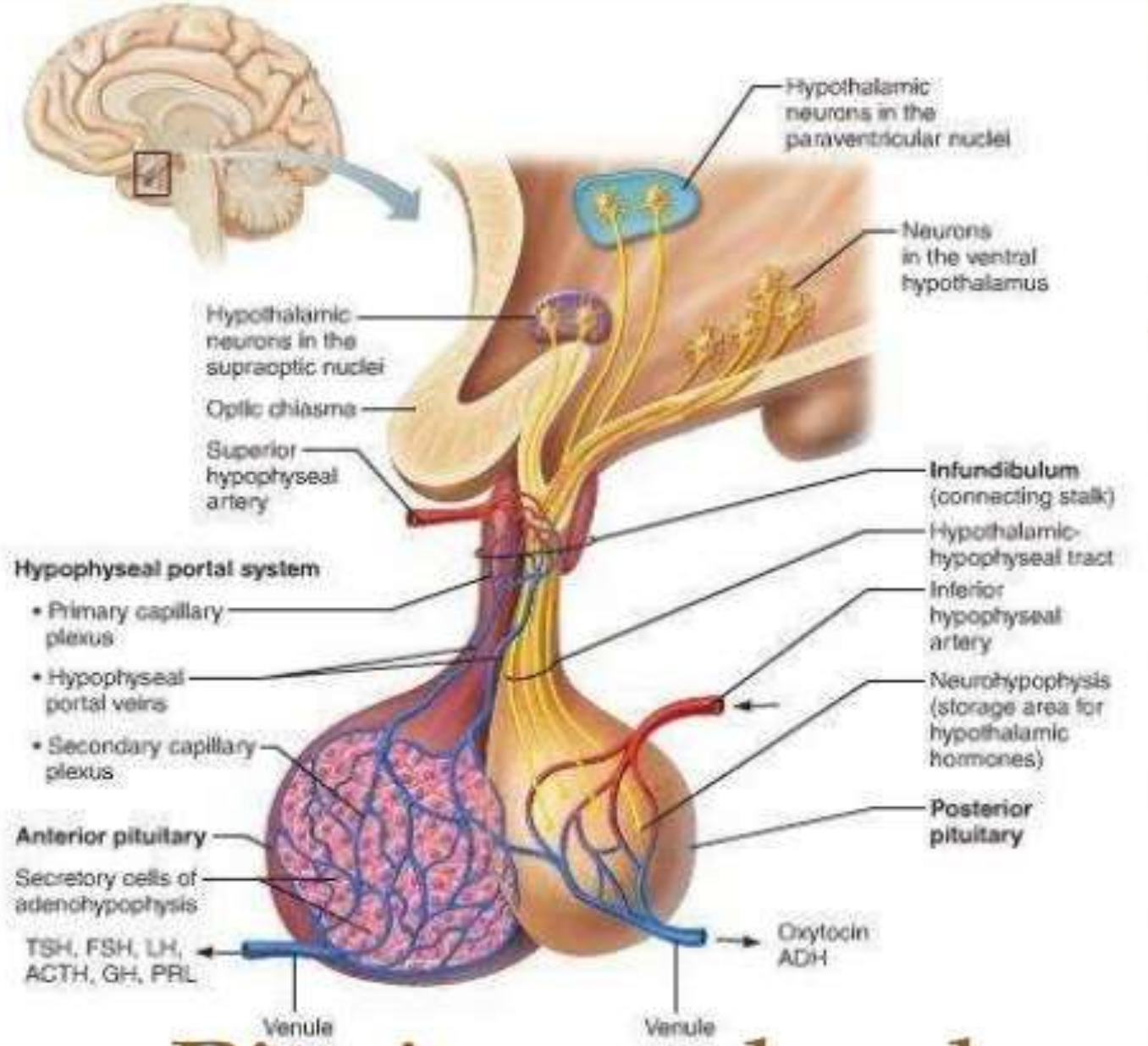
- The pituitary gland or hypophysis is attached to the hypothalamus (at the base of brain)

- The hypothalamus is the connecting link between the nervous system and endocrine system

- Pituitary gland is also known as master gland of the body

The pituitary gland can be divided in to two parts

1. Anterior pituitary (anterior lobe) (adenohypophysis)
2. Posterior pituitary (posterior lobe) (neurohypophysis)



Pituitary gland

Anterior pituitary gland releasing hormones:

7 types of hormones

1. Growth hormones (GH)
2. Thyroid stimulating hormone (TSH)
3. Adrenocorticotropic hormone (ACTH)
4. Prolactin hormones (PRL) or luteotropic hormone
5. Luteinizing hormone (LH)
6. Melanocyte-stimulating hormone (MSH)
7. Follicle-stimulating hormone (FSH)

Posterior pituitary gland releasing hormones:

2 type of hormones

1. Anti diuretic hormones (ADH) OR vasopressin
2. Oxytocin

Table no .1 Summary of the hormones released by anterior pituitary gland

Hormones	**Function**
Growth hormones	Regulate metabolism, promotes tissue growth specifically bones and muscles
Thyroid stimulating hormone (TSH)	Stimulate growth and activity of thyroid gland and secretion of their hormones
Adrenocorticotropic hormone (ACTH)	Stimulates the adrenal cortex to secrete the glucocorticoids
Prolactin (PRL)	Stimulates the growth of breast tissue and milk production
Follicle-stimulating hormone (FSH)	Stimulates the production of sperm and maturation of ovarian follicles and ovulation
Luteinizing hormone (LH)	Stimulate the testosterone and progesterone

Anterior pituitary gland releasing hormones:

Growth hormones(GH): this is the most abundant hormone synthesised by the anterior pituitary.

- It stimulates growth and division of most body cells specially bones and skeletal muscles
- It release is **stimulated** by the growth hormone releasing hormone **(GHRH)**
- Its release is **inhibited** by the growth hormone release inhibiting hormone **(GHRIH)** or **somatostatin**
- Both stimulated and inhibited hormones are secreted by the **hypothalamus**
- Secretion of GH is increase at night during sleep, in cause of hypoglycaemia (low blood sugar), exercise, anxiety and peak in adolescence, decline with age.

Growth hormone deficiency (Hypo) : Dwarfism

Growth hormone excess secretion (Hyper): Acromegaly, gigantism

Thyroid hormone: the release of this hormone is stimulated by thyrotrophin releasing hormone (TRH) from the **hypothalamus**

Basically there are two type of hormones released by thyroid gland,

Iodine is essential for the formation of this hormone.

T3 : Tri-iodothyronine

T4 : Thyroxine

Both T3 and T4 are essential for normal growth and development of the whole body, specifically nervous system and skeleton system

Thyroid hormone deficiency : Hypothyroidism (goitre)

Excess concentration of thyroid hormone : Grave's disease

Adrenocorticotropic hormone (ACTH): Corticotrophin releasing hormone (CRH) promotes the synthesis and releasing of ACTH

This increases the concentration of cholesterol and steroids with adrenal cortex

ACTH deficiency: (hypoadrenalism) resulting in adrenal hormone insufficiency

ACTH hyper concentration : Cushing's syndrome

Prolactin:

This hormones is stimulated by prolactin releasing hormone (PRH)

It is lowered by prolactin inhibiting hormone (PIH, dopamine)

This hormone is secreted during pregnancy to prepare the breast for lactation after child birth

Gonadotropins : gonadotropins are hormones synthesized and released by the anterior pituitary, which act on the gonads (testes and ovaries) to increase the production of sex hormones and stimulate production of either sperm or ova.

Rising the level of these hormones at the age of puberty and promote the mature functioning of reproductive organs in both males and females

Two main gonadotrpins are :

Follicle stimulating hormone (FSH)

Luteinizing hormones (LH)

FSH

In female: secrete the estrogen and progesterone

In male: promote the spermatogenesis

LH

In female: ovulation, progesterone

In male: testosterone secretion

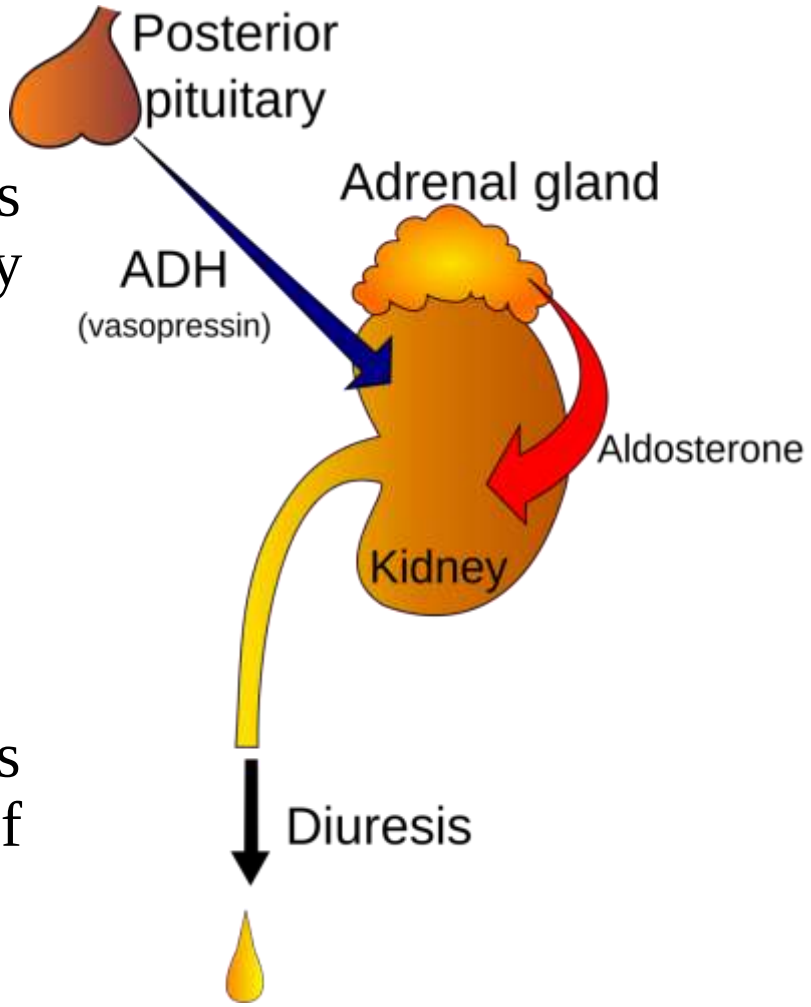
Posterior pituitary gland releasing hormones

1. Anti diuretic hormones (ADH) OR vasopressin:

- ADH is made by the hypothalamus and it is stored in posterior pituitary gland
- ADH have the two primary functions

I. To retain water in body

II. To constrict the blood vessels



Hypo secretion of ADH: Diabetes insipidus (excess retention of water), polyuria

Hyper secretion of ADH: syndrome of inappropriate ADH

2. Oxytocin

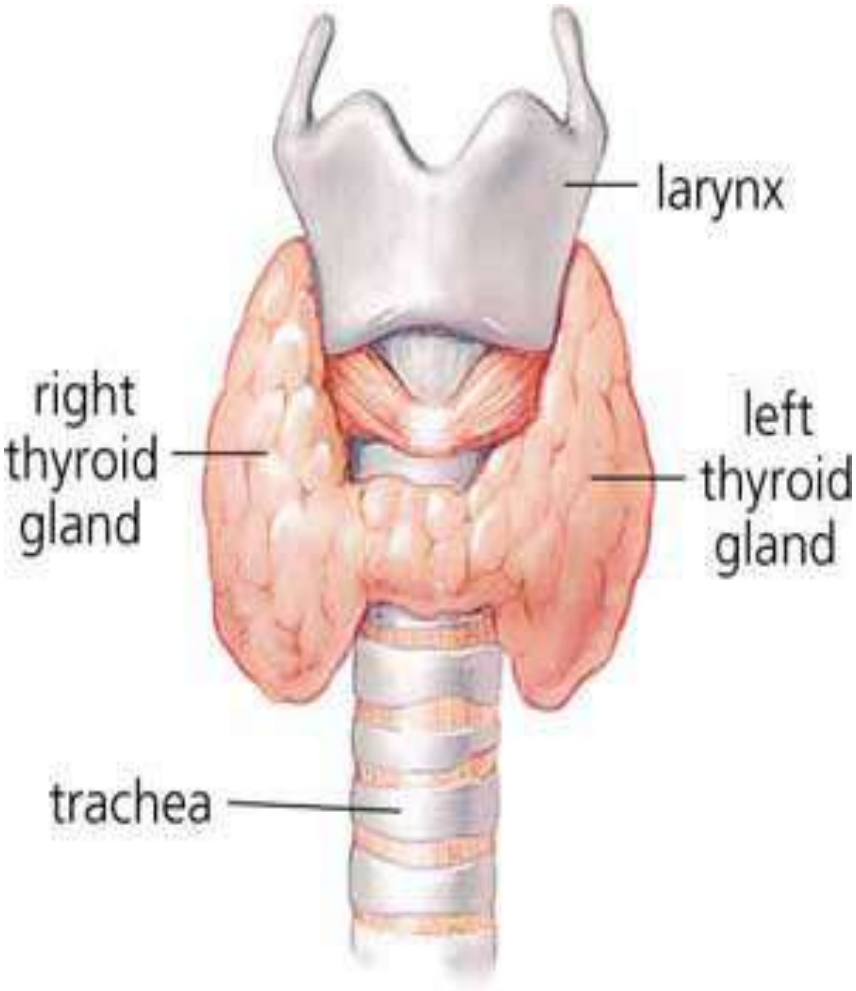
1. It is made by the hypothalamus and it is stored in posterior pituitary gland
2. It stimulate the contraction of memory gland to produce milk
3. It stimulate the contraction of uterus at the time of child birth

Thyroid gland

Thyroid gland is situated in the neck , in the front of larynx and below the adam's apple

It is highly vascular , about 25 g in weight

The thyroid is a butterfly-shaped gland , consisting from two connected lobes



Microscopically, the functional unit of the thyroid gland is the

1. Thyroid follicle
2. Follicular cells (thyrocytes)
3. Para follicular cell containing colloid

The thyroid gland secretes **three** hormones:

The two thyroid hormones : tri-iodothyronine (T3)

thyroxine (T4)

One peptide hormone : calcitonin hormone

The thyroid hormones influence the metabolic rate and protein synthesis, and in children, growth and development.

Calcitonin play the important role in homeostasis of calcium level

Thyroid hormone deficiency : Hypothyroidism (goitre), hashimoto's disorder

Excess concentration of thyroid hormone : Grave's disease

Calcitonin: osteoclasts (break the bone)

Parathyroid gland

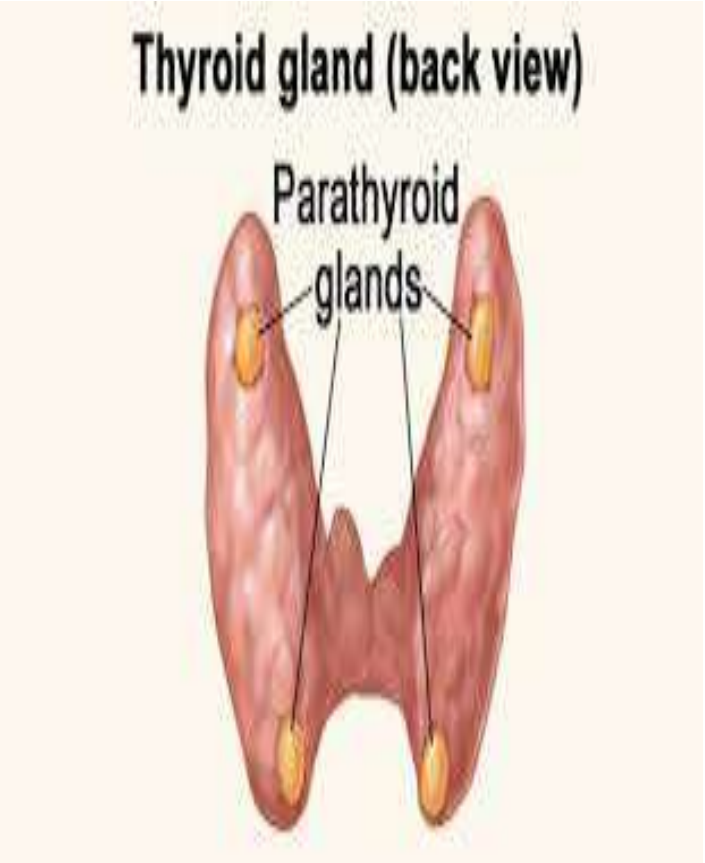
There are four small parathyroid glands, each having the 50 g weight

Parathyroid gland is essential for life and it secrete the parathyroid hormone

Its main function is increase the blood calcium level

Hypo-parathyroidism: rickets, osteomalacia

Hyperparathyroidism: polyuria, anorexia



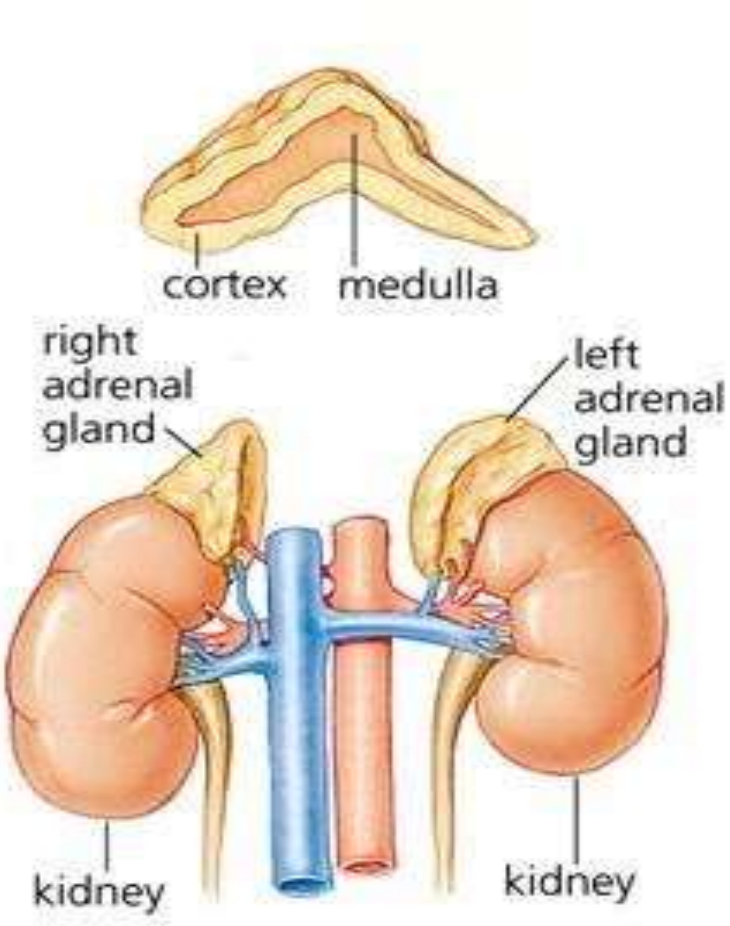
Adrenal gland

There are two Adrenal gland or suprarenal gland

They are about 4 cm long and 3 cm thick

there are two part

1. Outer **adrenal cortex**
2. Inner **adrenal medulla**



Adrenal cortex

It produce the **three** hormones

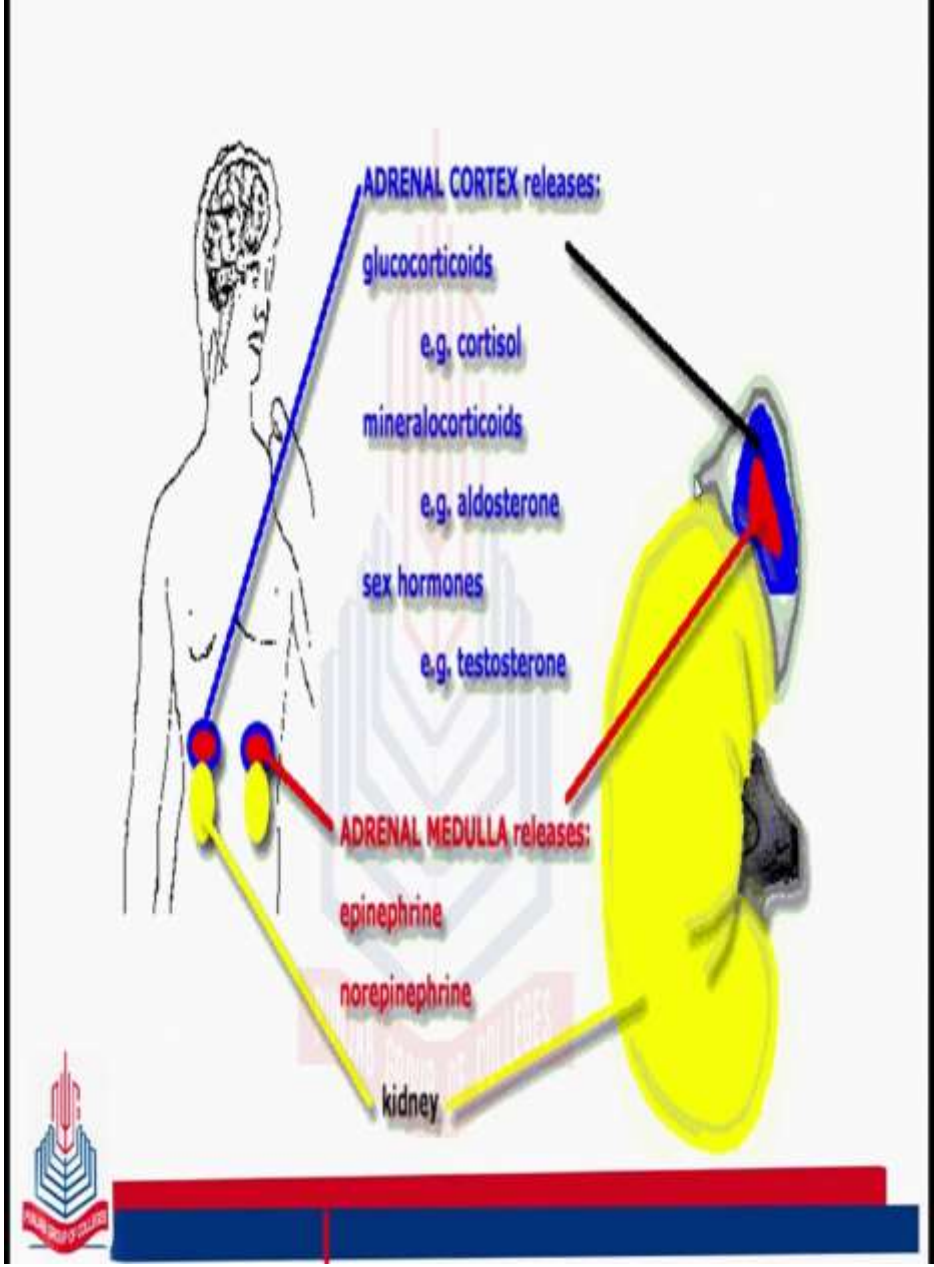
1. **Glucocorticoids**
2. **Mineralocorticoids**
3. **Sex hormones**

These are collecteviely known as **adrenocorticoids**

1. Glucocorticoids

Cortisol, corticosterone and cotisone , these are the main glucocortcoids

They are essential for life , regulating stress and metabolism



It promote the **gluconeogenesis** and **lipolysis**

It have the anti-inflammatory action, suppress the immune response, suppress the wound healing

2. Mineralocorticoids

Aldosterone is the main mineralocorticoids

It maintain the **water and electrolyte balance**

3. Sex hormones

Sex hormone secreted by adrenal cortex is androgen (male sex hormones)

Hyposecretion of glucocoticoids and mineralocorticoids: Addison's disease

Hypersecretion of glucocoticoids: Cushing' syndrome

Adrenal medulla

It is surrounded by the cortex

It produce the two hormones

- adrenaline (80%) (epinephrine)
- noradrenaline (20%) (norepinephrine)

Both adrenaline and noradrenaline having the similar functioning :

They increase the heart rate , increasing the blood pressure, increase the metabolic rate

Hypersecretion of adrenaline or noradrenaline cause the

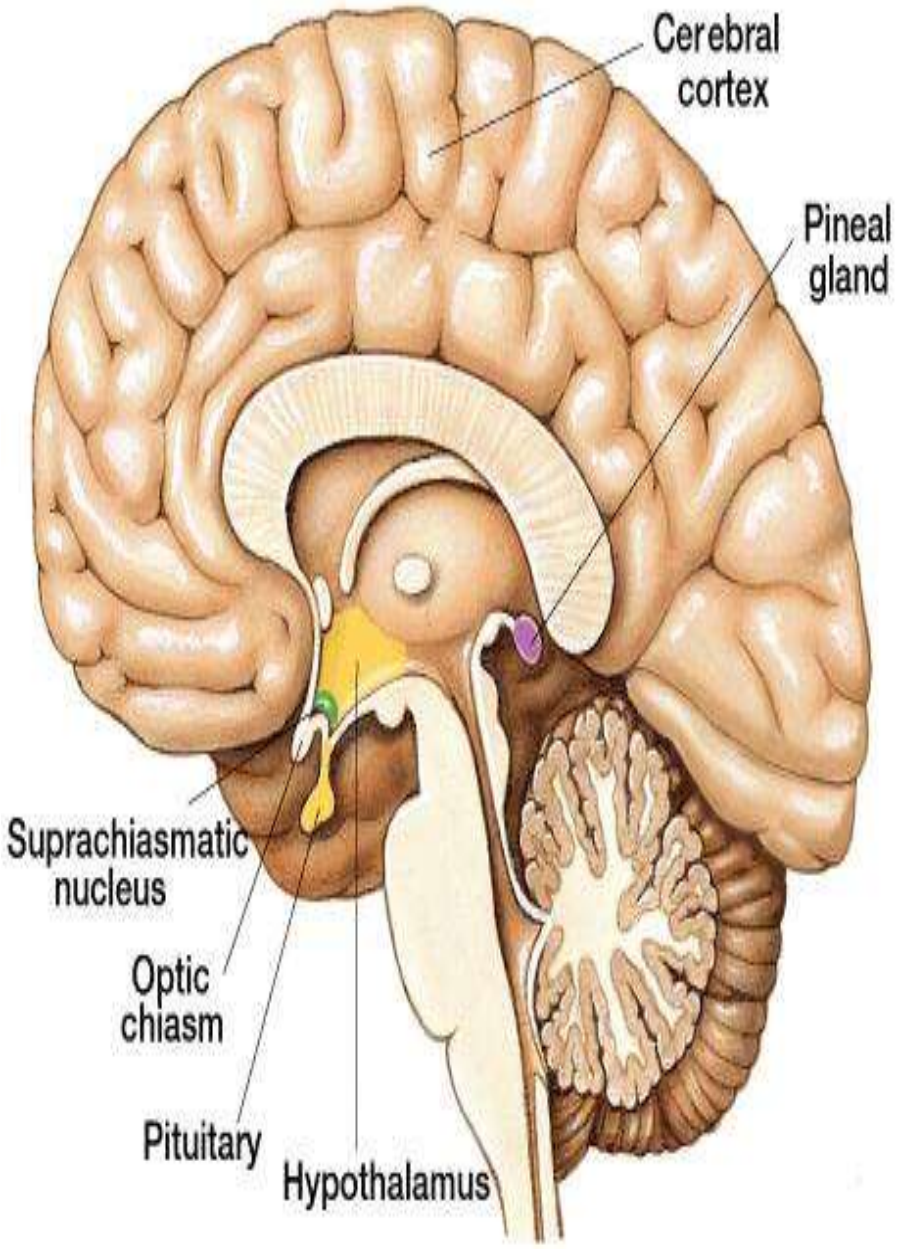
Hypertension, hyperglycemia, raised metabolic rate

Pineal gland

1. It is small body, attached to the roof of hypothalamus
2. It is a small, pea-shaped gland in the brain, it is approx 10 mm long, reddish brown in colour
3. The gland tends to atrophy after puberty and may calcified after that

Physiological role of pineal gland is remains unclear

it secret the melatonin, which is modulate the sleepiness and regulate the body's biological clock



Sex gland (gonads)

The **ovaries** and **testes** are paired oval shaped organ referred to as gonads

Ovaries

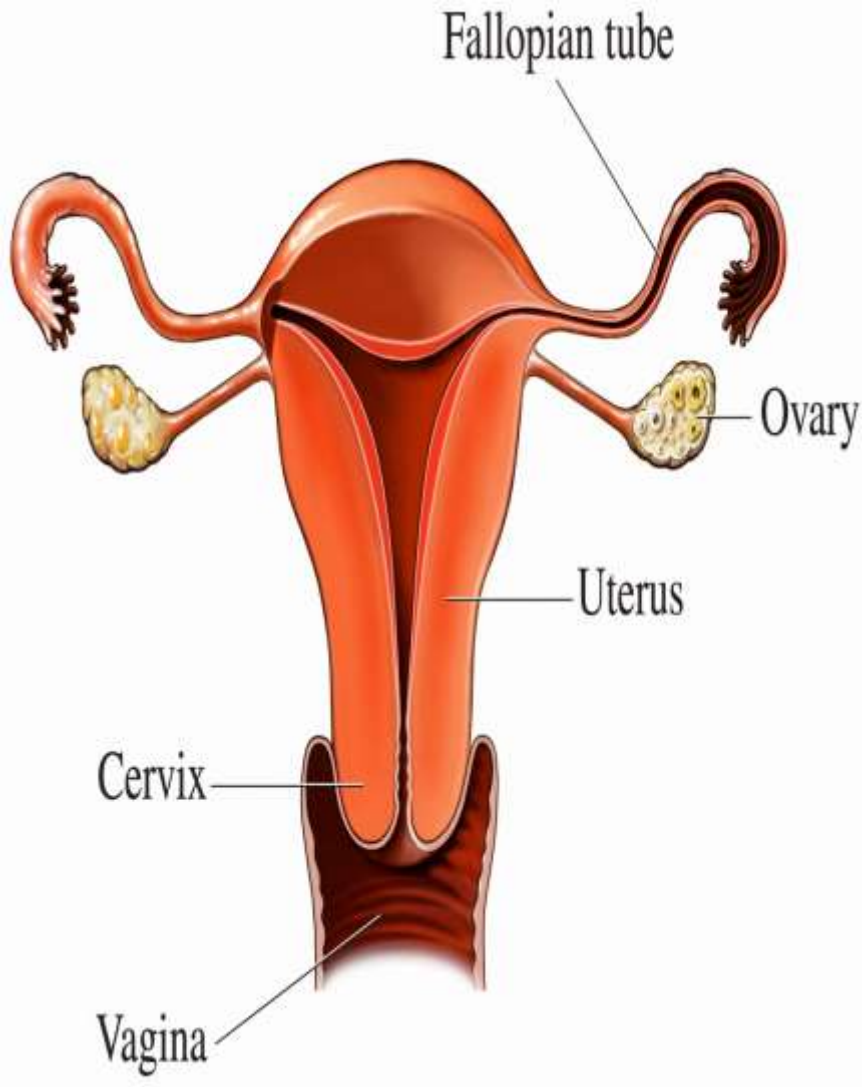
1. The ovaries are the female gonads, located in the pelvic cavity
2. They secrete the two most important female hormone

Estrogens

Progesterone

Both hormone maintain the female reproductive system as well as female sexual characteristics

The ovaries also produce the relaxin hormone, which soften the conncetive tissues in prepration of child birth



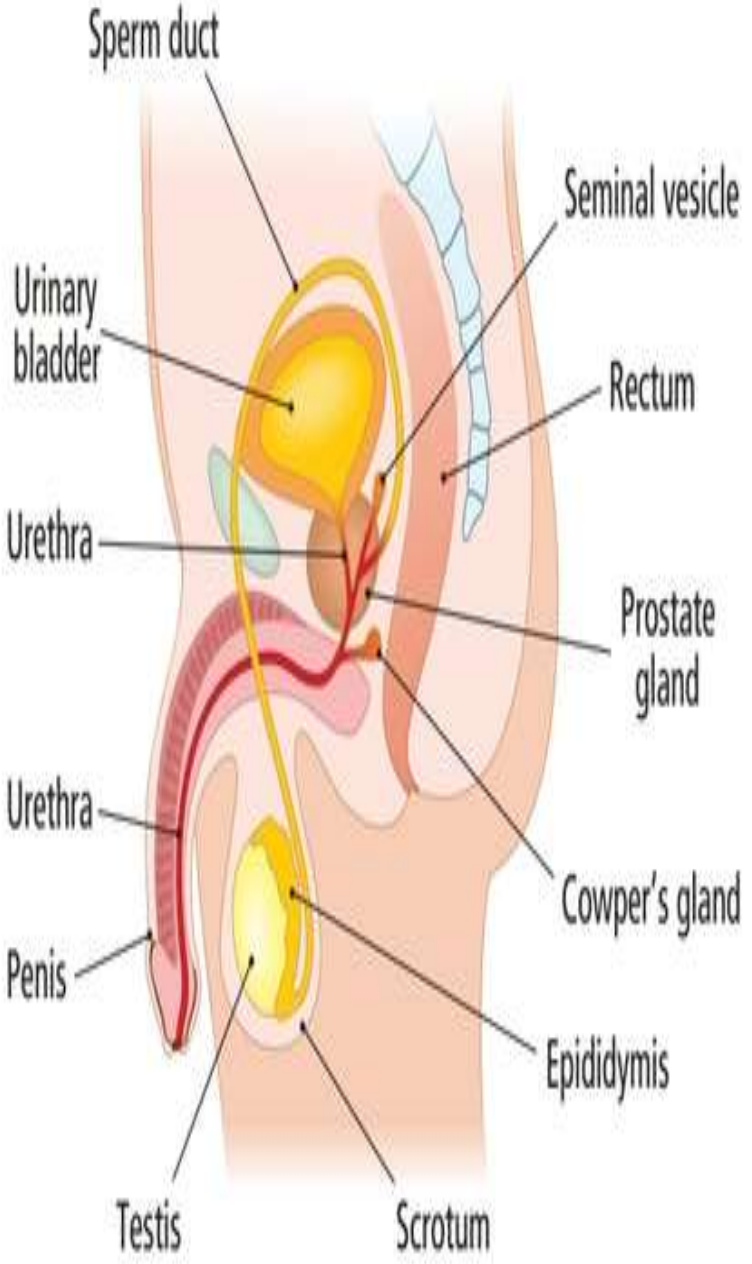
Testes

1. The testes are the male gonads, located in the scrotum

   They secrete the most important male hormone

Testosterone

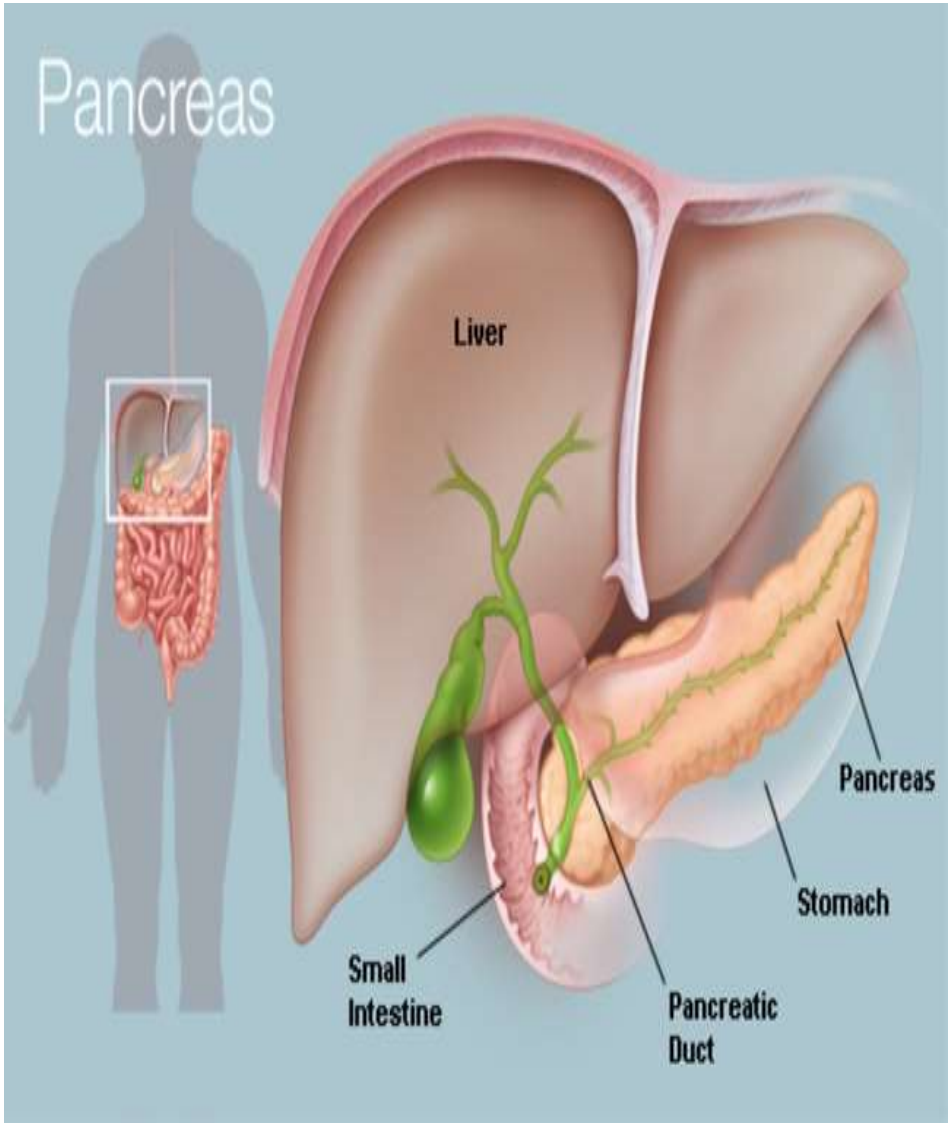
Which is responsible for the male sexual characteristics and by inhibin (by Sertoli cell), it control the sperm production



Pancreas

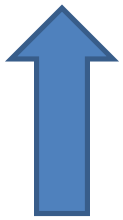
1. The pancreas is classified as **mixed** organ i.e. it acts like both exocrine and endocrine organs
2. There are **three** main types of cells in pancreatic islets (group of pancreas cells):

- **α**(alpha) cell, secrete the **glucagon**
- **β**(beta) cell are most numerous cell, secrete the **insulin**
- **δ** (delta) cell, secrete the **somatostatin**



The normal range of glucose level is 63-144 mg/100ml

Blood glucose levels are **maintained** by the **opposing action** of insulin and glucagon

Glucagon increase the blood glucose level 

Insulin decrease the blood glucose level 

Insulin

1. Its main function is to lower the glucose level as well as amino acids and fatty acids also.
2. These effect are referred as anabolic effect i.e. it promote the storage of nutrients, when these nutrients are present in excess amount, specifically glucose by the glycogenesis (glucose into glycogen), insulin promote their storage immediately

Glucagon

1. Glucagon increase the blood glucose level by the process of glycogenolysis (glycogen convert into glucose)

Somatostatin

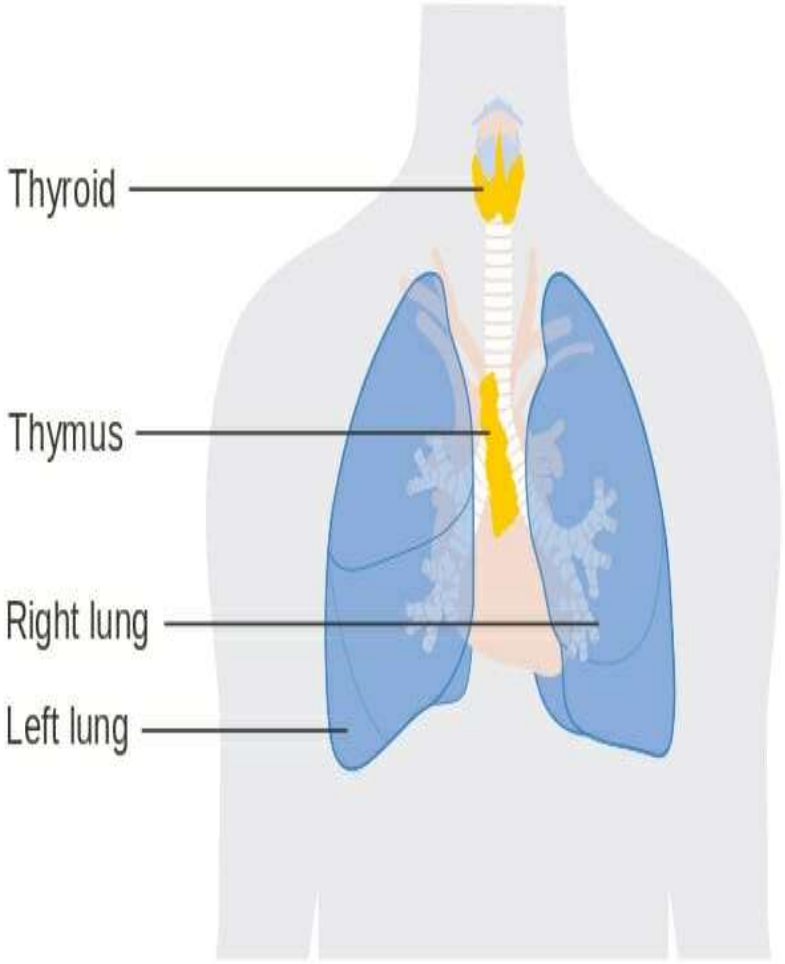
1. Also known as growth hormone-inhibiting hormone
2. It inhibit the insulin, glucagon and growth hormone from anterior pituitary gland

Thymus gland

1. Thymus gland are produced the hormones is known as **thymosin**,

2. **Thymosin** are the hormone, which promote the proliferation and maturation of T cells (which is also known as T lymphocytes cells, responsible for phagocytises process)

3. It maintain the immunity of the body and retard the aging process

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